EE 495 - Audio Amplifier Design

2001/02 Curriculum Handbook Data

El Engr 495. Special Topics. 1-3(1). Selected topics in electrical engineering. Typical subjects include audio power amplifier design, laser optics and weapons, advanced signal and image processing, and advanced electronics circuits. Final project. Prereq: Department permission. Sem hrs and offering time determined by department (not more than 3 sem hrs).

Course Pre-requisites by Topic

1. Semi-conductor devices [EE 321, EE 322]
2. Small signal device models [EE 321, EE 322]

Additional Topical Requirements

1. Circuit analysis [EE 231, EE 332]
2. Bode plots (gain/phase) [EE 332]

Course Goal

The goal of this course is for cadets to develop an in-depth understanding of discrete electronic devices and their interaction when organized into a complex amplifier system. Then use that knowledge to design, build, troubleshoot, and test a complete amplifier design, meeting a given set of specifications.

Course Objectives

Cadets shall be able to:

1. Use multiple electronic devices to organize multistage systems to meet specific specifications
   a. Examine in depth the operation of electronic devices (primarily the bipolar junction transistor (BJT))
   b. Examine the mathematical models for BJTs and become familiar enough with them to understand the concepts of input/output impedance, voltage/current gain, bandwidth, etc.
2. Design, model, build, and troubleshoot an amplifier design
   a. Examine amplifier topologies and understand pros/cons of each
   b. Investigate system critical amplifier parameters such as local/global feedback, stability, loading, etc.
3. Research a topic or a topology for a contemporary amplifier design, write a cohesive paper on the subject, and make a concise presentation of the paper

Course Objectives (COs) Relationship to Program Curricular Outcomes (PCOs)

PCOs / COs	1	2	3	4	5	6	7	8	9	10	11	12
EE 495-1	X		X	X								
-2	X	X	X	X			X					
-3	X				X							

Professional Component

1	Environmental, political, and social considerations	None
2	Health and safety considerations	Safety issues relating to dealing with 115VAC sources in designing power supplies, chassis design, and grounding.
3	Economic considerations	Component selection and the impact of those choices on product cost.
4	Manufacturability and sustainability	Chassis, circuit board, and power supply design and integration are discussed.
5	Contemporary issues	Power amplifier topologies, specifications, and measurements in relation to the perceived sound quality of the design.
6	Engineering ethics	The care required when using other designer's ideas (copyright and patents).

Engineering Science: 40 %
Engineering Design: 60 %

Assessment Methods That Support Measurement of Course Objectives

Assessment Method	Obj 1	Obj 2	Obj 3
Graded Reviews	X	X	
Laboratory Assignments	X	X	
Quizzes	X		
Research Paper	X		X
Final Project	X	X	

Assessment Method Details

Graded Review:
The Graded Review shall contain problems designed to test knowledge and comprehension of discrete electronic devices. Emphasis will be on BJTs but will also include diodes and passive devices and their characteristics. Design questions will be asked to probe the cadets' ability to chose configurations, organize biasing, and select parts to meet specific design criteria. Use of the engineering problem solving method

will be expected and specific problems (or groups of problems) will be designed to assess each objective. Cadet performance on each problem will be recorded and analyzed for the semester in a course database.
Success: For each objective the average score for all cadets in the course is 73% or better.

Labs:
Laboratory exercises in this course are very open-ended and cadets are required to personally conduct the experiments but are encouraged to work together to aid in understanding. The cadet is encouraged to explore, analyze, and ask "what if" questions and provided the time to do so. Laboratory notebooks will be required and handed in for assessment. The grading criteria will include neatness, completeness, and thoroughness of the investigation.
Success: The average score for all labs for all cadets in the course is 80% or better.

Quizzes:
Quizzes will be used to assess independently the knowledge and comprehension gained by each cadet in their laboratory work. The quizzes will cover basic knowledge of concepts, analysis techniques, and design ability.
Success: For each objective the average score for all cadets in the course is 73% or better.

Research Paper:
This project will be divided into two segments. The first will be done prior to mid-semester and will include the initial research on an amplifier area of interest. A topic could be a specific design to study and analyze or a general topology to examine. The final section will be a thorough analysis and description of the topic and will be presented in class around Lesson 30 of the course. Assessment will include the writing skill, technical understanding, and presentation of the topic. Separate grades will be assigned to writing, technical content, and presentation.
Success: The average score for each of the three areas, writing, technical content, and presentation is 73% or better.

Final Project:
This is the capstone of the course. An entire amplifier will be designed, constructed on a proto-board, debugged, and tested. Each cadet will be required to complete the project. A thorough lab notebook will be required and a demonstration of the amplifier's performance will constitute the assessment method.
Success: A working and demonstrable amplifier for each cadet will constitute a successful completion and stand as a minimum grade of 80%.

Course Director's Subjective Assessment

In the Course Report at the end of the semester, the Course Director will assign a subjective score on a scale of one to ten to assess the delivery and accomplishments of the course. This evaluation will assess each of the following areas:

- Were objectives met using the above assessment methods and success criteria?
- Was the course flow appropriate (order of topics, time spent on each topic, scope of GRs, etc)?
- Cadet feedback via formal critiques and informal comments.
- Instructor feedback as recorded in the course log.
- Was instructor effort consistent with the student learning achievements?
- Was integration of course activities (homework, quizzes, GRs, labs, presentations, etc) appropriate for the objectives?

Scale Definitions:

10 - no adjustments are necessary
9 - only administrative changes are required
8 - a few minor changes are needed in one or two areas
7 - minor changes in many areas
6 - a major change in some area
5 or less - more than one major change is needed to improve the course.